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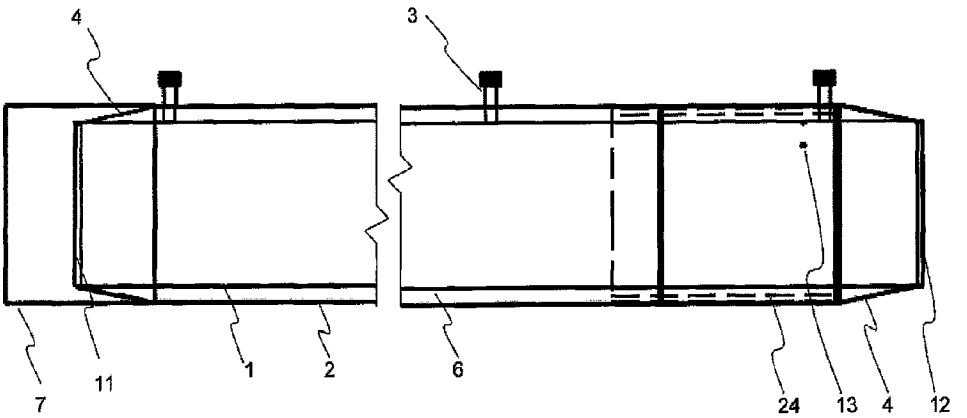

(57) Abrégé/Abstract:
Duct for air transport, said duct comprising an inner jacket (1) having an inlet end (11) for connecting the duct to an air supply and an outlet end (12) for connecting the duct to a duct for a further transport or distribution of air, and an outer jacket (2) made of an impervious material and surrounding the inner jacket (1) spaced therefrom, wherein an insulation chamber (6) is formed between the inner jacket (1) and the outer jacket (2). The inner jacket (1) and the outer jacket (2) are adapted to conduct from the interior space of the inner jacket through the insulating chamber (6) into the ambient atmosphere, namely in an amount of 0.02 to 100 ▯, preferably 0.03 to 10 ▯, especially 0.03 to 1,3 ▯, most preferably 0, 1 to 0,8 ▯ of the total volume of air fed into the inner jacket (1), wherein the area for conducting air into the insulating chamber (6) and the area for conducting air away from the insulating chamber (6) being spaced from each other during the operation of the duct.

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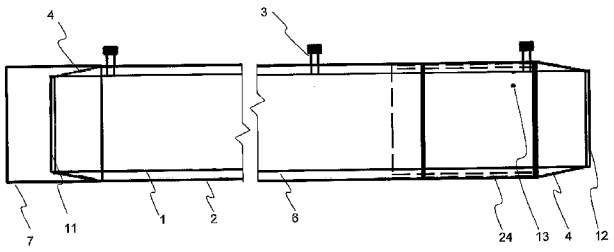
Fig. 2



(57) Abstract: Duct for air transport, said duct comprising an inner jacket (1) having an inlet end (11) for connecting the duct to an air supply and an outlet end (12) for connecting the duct to a duct for a further transport or distribution of air, and an outer jacket (2) made of an impervious material and surrounding the inner jacket (1) spaced therefrom, wherein an insulation chamber (6) is formed between the inner jacket (1) and the outer jacket (2). The inner jacket (1) and the outer jacket (2) are adapted to conduct from the interior space of the inner jacket through the insulating chamber (6) into the ambient atmosphere, namely in an amount of 0.02 to 100 ‰, preferably 0.03 to 10 ‰, especially 0.03 to 1,3 ‰, most preferably 0, 1 to 0,8 ‰ of the total volume of air fed into the inner jacket (1), wherein the area for conducting air into the insulating chamber (6) and the area for conducting air away from the insulating chamber (6) being spaced from each other during the operation of the duct.

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Duct for air transport

Field of the invention

The present invention relates to a duct for air transport, the duct comprising an inner jacket having an inlet end connectible to an air supply and an outlet end connectible to a duct for a further transport or distribution of air, and an outer jacket made of an impervious material and surrounding the inner jacket spaced therefrom, wherein an insulation chamber is formed between the inner jacket and the outer jacket.

Background of the invention

In air-conditioning industry, textile ducts are used especially for air distribution, i.e. in rooms, for which the air is intended. Contrarily, metallic ducts are used to transport air towards the respective rooms, the metallic ducts being however substantially heavier, more expensive, more space-consuming and more difficult to clean in comparison to the textile ducts. Alternatively, textile ducts can also be used for conveying air provided that the textile material is imperviously coated, e.g. with PVC, in order to prevent air from being lost while being conveyed. Nevertheless, when cooled air is conveyed through rooms / areas, where high temperatures and/or humidity prevail, condensation occurs on the surface of such ducts causing condensate to drip down therefrom.

This problem can be solved by wrapping an insulating material around the entire duct. This is, however, uneconomic both with regard to the manufacturing cost and with regard to the maintenance cost. Moreover, the weight of the duct becomes significantly higher.

In accordance with US 7,442,121, the aforesaid problem is solved by providing a duct that comprises an inner air-pervious layer, an outer impervious layer and multiple braces arranged between the two layers. The supplied air flows along the inner air-pervious layer of the duct but partly passes through that layer into the space between the inner and outer layers, thus forming an insulation that reduces the risk related to the occurrence of condensation on the outer surface of the duct. The drawbacks of the aforesaid technical solution consist in the complexity of the same and in an insufficient flexibility with regard to adjustment of the air permeability of the inner layer of the duct. In addition to that, the air permeability of said layer

spontaneously fluctuates during the operation which is due to the fact that the pores of the textile material gradually become clogged by the impurities contained in the supplied air. Another drawback consists in that the supplied air penetrates the insulating layer along the entire length of the duct, thereby having a temperature, which is similar to that prevailing inside the duct, along the entire length of the duct. In view of the fact that, according to the prior art document, air from the insulating chamber is to be fed to the place of distribution, connection of such duct to an air diffuser is complicated from structural point of view.

Summary of the invention

The above mentioned drawbacks of the prior art are largely eliminated by a duct for air transport, said duct comprising an inner jacket having an inlet end for connecting the duct to an air supply and an outlet end for connecting the duct to a duct for a further transport or distribution of air, and an outer jacket made of an impervious material and surrounding the inner jacket spaced therefrom, wherein an insulation chamber is formed between the inner jacket and the outer jacket. According to the invention, the inner jacket is adapted for conducting air away from the interior space of the jacket into the insulating chamber and the outer jacket is adapted for conducting air away from the insulating chamber into the ambient atmosphere, namely such that the amount of air conducted away from the inner jacket through the insulating chamber into the ambient atmosphere is 0.02 to 100 ‰, preferably 0.03 to 10 ‰, especially 0.03 to 1,3 ‰, most preferably 0,1 to 0,8 ‰ of the total volume of air fed into the inner jacket, the area for conducting air into the insulating chamber and the area for conducting air away from the insulating chamber being spaced from each other.

Preferably, the area for conducting air into the insulating chamber is arranged at one end of the duct, preferably at the outlet end of the duct, and the area for conducting air away from the insulating chamber is arranged at the other end of the duct.

According to particularly preferred embodiment, the inner jacket is made of an impervious material and provided with at least one interconnecting opening for conducting a partial amount of air from the inner jacket into the insulating chamber and the outer jacket is provided with at least one blow-off opening for conducting air away from the insulating chamber, the latter opening being arranged in an area

adjoining the inlet end of the duct, the total area of all the blow-off openings being less than or equal to the total area of all the interconnecting openings.

In order to provide said amounts of air being led into the ambient atmosphere and to ensure proper inflation of the insulation chamber, the inner jacket is made preferably of an impervious material and provided with at least one interconnecting opening for conducting a partial amount of air from the inner jacket into the insulating chamber, the total surface area of all the interconnecting openings ranging between 0.04 and 2.5 ‰ of the surface area of the internal cross section of the inner jacket, and the outer jacket is provided with at least one blow-off opening for conducting air away from the insulating chamber, the total surface area of all the interconnecting openings being 2 to 8 times, particularly 5 or 6 times greater than the total surface area of all the blow-off openings.

The interconnecting openings are arranged preferably in an area adjoining the outlet end of the inner jacket, yet spaced therefrom, and the blow-off openings are arranged in an area adjoining the inlet end of the duct.

It is also advantageous, when the outer jacket is, at least in the area facing the interconnecting openings, provided with a layer of an insulating material.

Preferably, the duct is provided with suspension elements, each suspension element comprising an end portion for anchoring the inner jacket, an intermediate portion for anchoring the outer jacket and a lug for attaching the duct to a carrying structure.

To enclose the insulating chamber in a direction corresponding to the radial direction of the duct, the duct further comprises – at each end - a funnel-shaped jacket for, the funnel-shaped jacket being attached to the inner jacket with its narrower end and to the outer jacket with its wider end.

According to an especially preferred embodiment, the duct has a circular cross section, the diameter of the inner jacket being by 25 to 60 mm, particularly by 35 to 45 mm, less than the diameter of the outer jacket.

Brief description of the drawings

The present invention will be further described in more detail with reference to the accompanying drawings showing exemplifying embodiments schematically. Fig. 1 shows an exemplary embodiment of the duct according to the present invention in a perspective view and Figs. 2 and 3 show the duct of Fig. 1 in a longitudinal

sectional view and in a cross-sectional view, respectively. Fig. 4 shows a suspension element for anchoring the duct in a detailed view.

Description of the exemplary embodiments

The exemplary textile duct shown in the drawings comprises a hose-like inner jacket 1 made of an impervious material, such as a woven fabric consisting of endless polyester fibres and provided with a bonding coat, e.g. of PU, PVC or silicone. The inner jacket 1 is surrounded by a hose-like outer jacket 2 wrapped around the former, the latter being also made of an impervious material, such as a woven fabric consisting of endless polyester fibres and also provided with a bonding coat, e.g. of PU, PVC or silicone. The space between the inner jacket 1 and the outer jacket 2 forms an insulating chamber 6 surrounding the inner jacket 1.

Such duct is washable, which is a major advantage of the invention.

In the particularly preferred embodiment shown in the drawings, the jackets 1, 2 have circular cross section. Nevertheless, they can have any other suitable cross section, such as a semi-circular, triangular or polygonal one. The walls of the outer jacket 2 extend along those of the inner jacket 1, yet spaced therefrom.

The inlet end 11 of the inner jacket 1 is adapted to be connected to an air supply, while the outlet end 12 is connectible to a downstream pipeline for subsequent transport and/or distribution of air.

A funnel-shaped jacket 4, which is arranged at the inlet end 11 of the inner jacket 1, is attached to the outer jacket 2 with its wider end and to the inner jacket of the duct with its narrower end, thus enclosing the insulating chamber 6 between the inner jacket 1 and the outer jacket 2 in an area adjoining the inlet section of the duct. In this exemplary embodiment, the outer jacket 2 extends beyond the funnel-shaped jacket 4 in the longitudinal direction, the extension being formed by an overlapping sleeve 7. A similar funnel-shaped jacket 4 is arranged at the outlet end of the duct, as well.

The duct is provided with suspension elements 3, each suspension element comprising an end portion 31 for anchoring the inner jacket 1, an intermediate portion 32 for anchoring the outer jacket 2 and a lug 33 for attaching the entire suspended assembly to a carrying structure (not shown). The distance between the end portion 31 and the intermediate portion 32 corresponds to the spacing between the inner jacket 1 and the outer jacket 2. When a cylindrical duct is concerned, the aforesaid

distance should be substantially equal to the difference between the radii of the outer jacket **2** and the inner jacket **1**. Preferably, the suspension element **3**, or at least the end portion **31** and the intermediate portion **32** of the suspension element, are also made of a textile material.

The internal surface of the outlet end **12** of the outer jacket **2** of the duct is provided with a layer **24** of insulating material, such as expanded polystyrene foam (Yatex). In Figs. 2 and 3, the layer **24** of an insulating material is indicated by a dashed line.

The inner jacket **1** is provided with at least one interconnecting opening **13** arranged in the area adjoining the outlet end **12**, said interconnecting opening leading from the internal space of the inner jacket **1** to the insulating chamber **6** formed between the inner jacket **1** and the outer jacket **2**. Preferably, the number of the interconnecting openings **13** ranges between 1 and 10. The outer jacket **2** is provided with at least one blow-off opening **23** arranged in the area adjoining the inlet end of the duct, said blow-off opening leading from the internal space of the insulating chamber **6** to the ambient atmosphere. Preferably, the number of the blow-off openings **23** ranges between 1 and 5. Preferably, the interconnecting opening(s) **13** is (are) arranged in the upper area of the duct. This means that the interconnecting openings are oriented in the same direction as the suspension elements **3**, while the blow-off openings **23** are oriented downwards, i.e. in the opposite direction with respect to the suspension elements **3**.

In general, both the interconnecting openings **13** and the blow-off openings **23** are adapted to conduct away an amount of air corresponding to 0.03 to 1.3 ‰ of the total volume of air fed into the inner jacket **1**. In the ducts working with the most common pressures and volume flow rates, this can be achieved by providing the inner jacket with the interconnection openings **13** having a total surface area which corresponds to 0.04 to 2.5 ‰ of the total cross-sectional area of the inner jacket **1**. Moreover, with the aim to maintain the inflated shape of the insulating chamber **6**, the total surface area of the interconnecting opening(s) **13** is 2 to 8 times, preferably 5 to 6 times greater than the total surface area of the blow-off openings **23**. In order to accomplish the above mentioned transfer of air, the size of the interconnecting openings **23**, which is suitable for a specific duct having predetermined volume flow rates, can also be found out by way of experiment.

According to a general definition, the inner jacket **1** and the outer jacket **2** should be adapted for conducting air away from the insulating chamber **6** in an amount of 0.02 to 100 ‰, particularly 0.03 to 10 ‰, preferably 0.03 to 1.3 ‰, most preferably 0.1 to 0.8 ‰.

In a particularly preferred embodiment of the present invention, the duct is cylindrical in shape, having a length of 1,000 to 5,000 mm and comprising an inner jacket **1** with a diameter of 200 to 1,500 mm and an outer jacket **2** with a diameter exceeding that of the inner jacket **1** by 25 to 60 mm, preferably by 40 mm, the total surface area of the interconnecting openings **13** ranging between 50 and 90 mm^2 (for example three circular interconnecting openings **13**, each having 5.5 mm in diameter, arranged on a circle and having mutual angular spacing of 35°) and the total surface area of the blow-off openings **23** ranging between 8 and 16 mm^2 (for example, one circular blow-off opening having 4 mm in diameter).

Theoretically, both the interconnecting openings **13** and the blow-off openings **23** can also be replaced with an insertable part made of a pervious material in order to enable a predetermined amount of air to pass from the interior space of the inner jacket **1** into the insulating chamber **6** and from the insulating chamber **6** to the ambient atmosphere. The incorporation of an area comprising a pervious material (a meshwork or a perforated sheet, among others) can be theoretically especially useful with regard to the outer jacket where, in the case of need, the possible clogging of the mesh with dust particles can be checked and easily eliminated. This is particularly the case when such a pervious material is removably attached to the impervious material of the outer jacket. For example, the pervious material can assume a form of a rectangular sheet for covering a larger opening formed in the jacket, such cover being attached to the jacket by means of velcro.

The element for enabling air to be conducted into the insulating chamber **6**, i.e. the interconnecting openings **13** or the corresponding pervious portion, and the element for enabling air to be conducted away from the insulating chamber **6** into the ambient atmosphere, i. e. the blow-off opening **23** or the corresponding pervious portion, are arranged with a mutual spacing which preferably corresponds to at least two thirds of the length of the inner jacket **1**, particularly with the greatest possible mutual spacing and with an additional angular shift. Thus, the element for enabling air to be conducted into the insulating chamber **6** can be oriented upwards and the element for enabling air to be conducted away can be oriented downwards.

When in operation, cooled air is blown into the duct according to the present invention, namely into the inlet opening of the inner jacket **1**, the respective volume flow rate being e. g. 1000 m^3/h and the respective static pressure being about 50 to 200 Pa, preferably amounting to 100 Pa. The absolutely greatest amount of the air will leave the duct through the outlet opening **12** of the inner jacket **1** and be led out into a downstream diffuser or to another downstream ducting element for air transport. Only a very small amount of air passes through the interconnecting openings **13** into the insulating chamber **6** and subsequently flows through the same towards the area adjoining the inlet end **12** of the inner jacket **1** in order to escape to the ambient atmosphere through the corresponding blow-off opening **23**. In view of the fact that the total surface area of the interconnecting openings **13** exceeds that of the blow-off openings **23**, a sufficient pressure can build up inside the insulating chamber **6** keeping the same in an inflated state, thereby maintaining the desired spacing between the outer jacket **2** and the inner jacket **1**. The static pressure acting inside the insulating chamber **6** is about half the static pressure acting inside the inner jacket **1** and ranges, e.g., from 30 to 100 Pa. Preferably, this pressure amounts to 50 Pa. Thereby, an insulating air layer is maintained around the inner jacket during the operation of the duct, said insulating layer enabling the condensation on the surface of the duct to be reduced or eliminated. The temperature of air, which prevails in the area of the insulating chamber **6** where air passes from the inner jacket **2** into the insulating chamber **6**, e. g. in the area adjoining the outlet end of the duct, is close to the temperature of air inside the inner jacket **1**. Therefore, it is useful to provide this area of the outer jacket **2** with a layer **24** of an insulating material, such as a foam one. The temperature prevailing in the portion of the insulating chamber **6**, which extends farther from the outlet end of the duct, is higher because the air flowing through the insulating chamber **6** gradually becomes warmer due to the influence of the ambient temperature. Therefore, there is no need to provide the portion extending farther from the outlet end of the duct **24** with any layer of an insulating material, at all.

The above exemplary embodiments are usable without implying any need of inserting or attaching a reinforcing structure. Nevertheless, it may be useful to provide non-circular ducts with reinforcing structures.

The outer jacket **2** is preferably made of a textile material. The inner **1** is also preferably made of a textile material but the scope of the present invention can

similarly include an additional alteration of a duct made of a metallic material with the aim to prevent condensation from occurring on the surface of such duct.

Although multiple exemplary embodiments are described above, it is obvious that those skilled in the art would easily appreciate further possible alternatives to those embodiments. Hence, the scope of the present invention is not limited to the above exemplary embodiments and is rather defined by the appended claims.

CLAIMS

1. Duct for air transport, said duct comprising:
   - an inner jacket (1) having an inlet end (11) for connecting the duct to an air supply and an outlet end (12) for connecting the duct to a duct for a further transport or distribution of air, and
   - an outer jacket (2) made of an impervious material and surrounding the inner jacket (1) spaced therefrom, wherein an insulation chamber (6) is formed between the inner jacket (1) and the outer jacket (2),

   characterized in that the inner jacket (1) comprises an area for conducting air away from the interior space of the jacket into the insulating chamber (6) and the outer jacket (2) comprises an area for conducting air away from the insulating chamber (6) into the ambient atmosphere, adapted such that the amount of air conducted away from the inner jacket (1) through the insulating chamber (6) into the ambient atmosphere is 0.02 to 100 ‰ of the total volume of air fed into the inner jacket (1), the area for conducting air into the insulating chamber (6) and the area for conducting air away from the insulating chamber (6) being spaced from each other during the operation of the duct.

2. Duct according to claim 1, **characterized in that** the area for conducting air into the insulating chamber (6) is arranged at one end of the duct and the area for conducting air away from the insulating chamber (6) is arranged at the other end of the duct.

3. Duct according to claim 1 or 2, **characterized in that** the inner jacket (1) is made of an impervious material and provided with at least one interconnecting opening (13) for conducting a partial amount of air from the inner jacket (1) into the insulating chamber (6) and the outer jacket (2) is provided with at least one blow-off opening (23) for conducting air away from the insulating chamber (6), the latter opening being arranged in an area adjoining the inlet end of the duct, the total surface area of all the blow-off openings (23) being less than or equal to the total surface area of all the interconnecting openings (13).

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4. Duct according to claim 1 or 2, **characterized in that** the inner jacket (1) is made of an impervious material and provided with at least one interconnecting opening (13) for conducting a partial amount of air from the inner jacket (1) into the insulating chamber (6), the total surface area of all the interconnecting openings (13) ranging between 0.04 and 2.5 ‰ of the surface area of the internal cross section of the inner jacket (1), and the outer jacket (2) is provided with at least one blow-off opening (23) for conducting air away from the insulating chamber (6), the total surface area of all the interconnecting openings (13) being 2 to 8 times, particularly 5 or 6 times greater than the total surface area of all the blow-off openings (23).

5. Duct according to claim 3 or 4, **characterized in that** the interconnecting openings (13) are arranged in an area adjoining the outlet end of the inner jacket (1), yet spaced therefrom, and the blow-off openings (23) are arranged in an area adjoining the inlet end of the duct.

6. Duct according to claim 3, 4 or 5, **characterized in that** the outer jacket (1) is, at least in the area facing the interconnecting openings (13), provided with a layer (24) of an insulating material.

7. Duct according to any one of claims 1 to 6, **characterized in that** it is provided with suspension elements (3), each suspension element comprising an end portion (31) for anchoring the inner jacket (1), an intermediate portion (32) for anchoring the outer jacket (2) and a lug (33) for attaching the duct to a carrying structure.

8. Duct according to any one of claims 1 to 7, **characterized in that** it further comprises, at each end, a funnel-shaped jacket (4) for enclosing the insulating chamber (6) in a direction corresponding to the radial direction of the duct, the funnel-shaped jacket being attached to the inner jacket (1) with its narrower end and to the outer jacket (2) with its wider end.

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9. Duct according to any one of claims 1 to 8, **characterized in that** it has a circular cross section, the diameter of the inner jacket (1) being by 25 to 60 mm, particularly by 35 to 45 mm, lesser than the diameter of the outer jacket (2).

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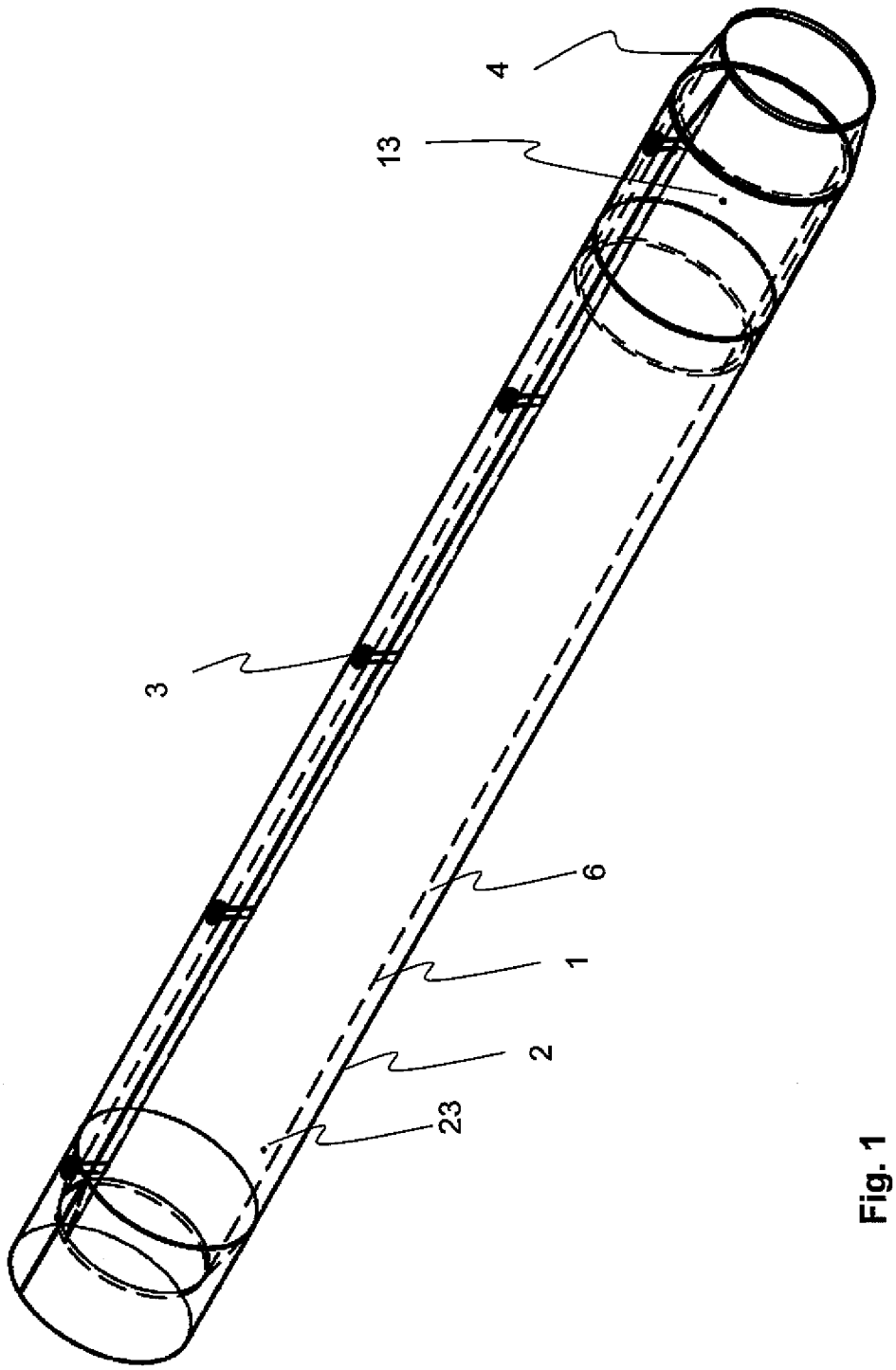


Fig. 1

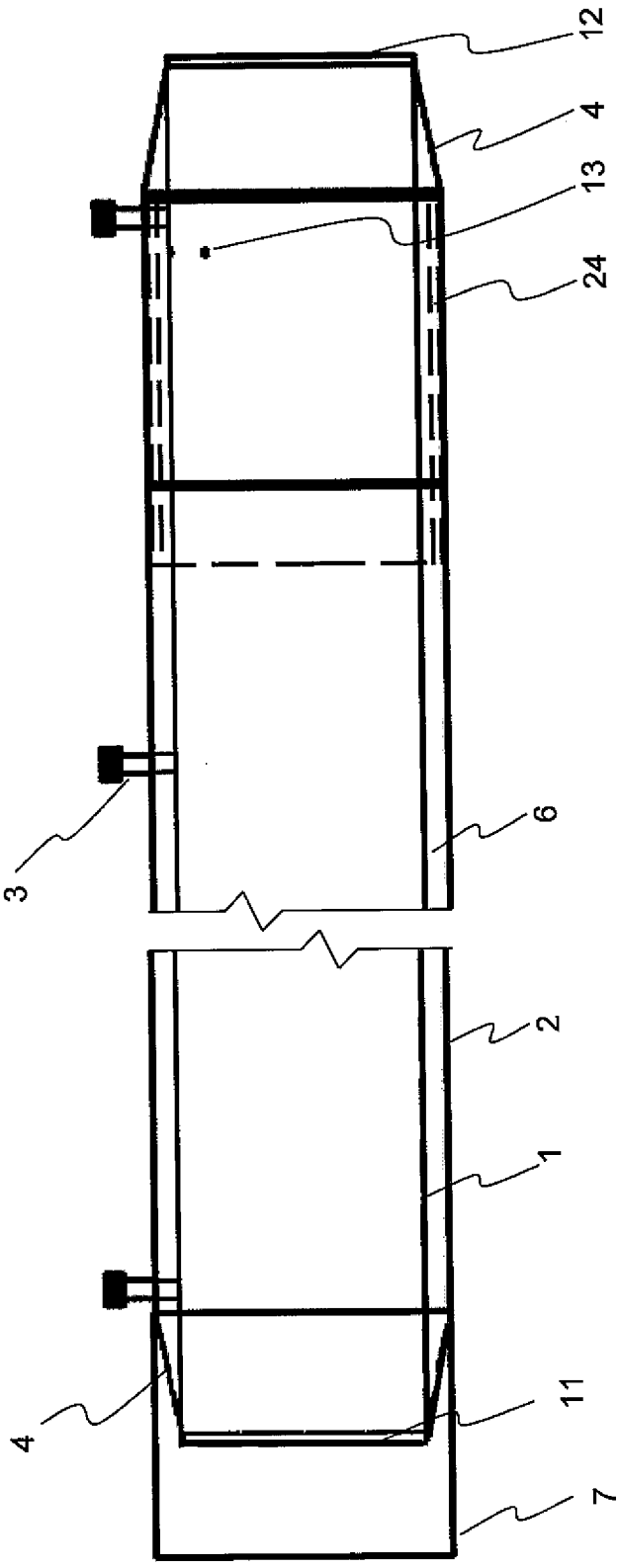


Fig. 2

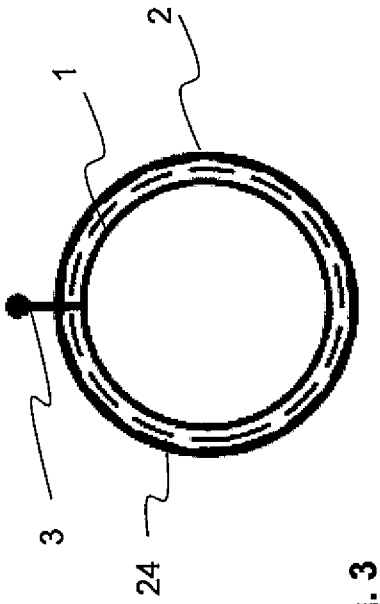


Fig. 3

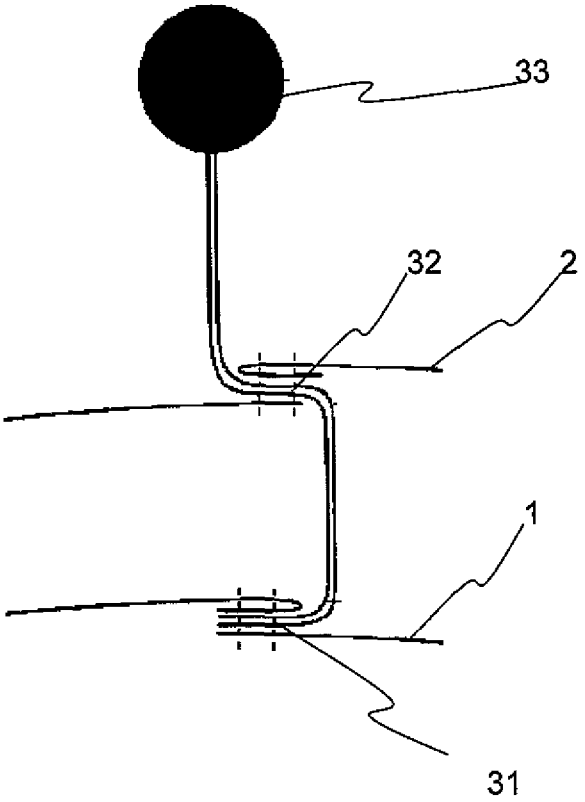
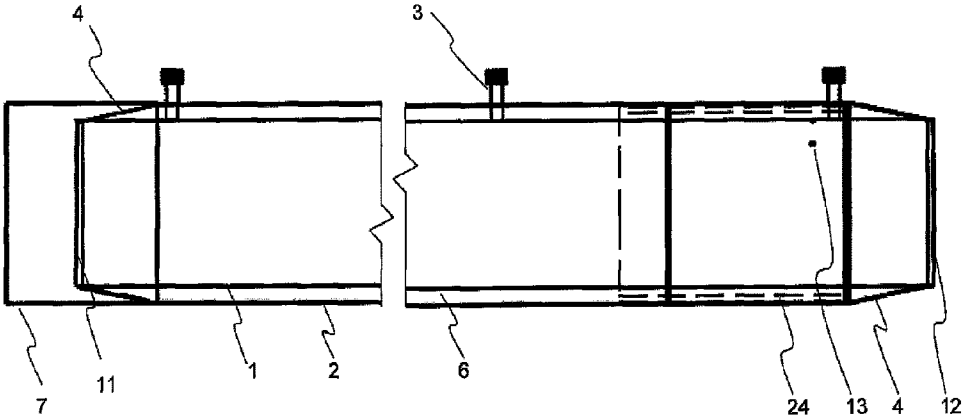


Fig. 4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